TEXAS AGRICULTURAL EXPERIMENT STATIONS.

BULLETIN No. 41.

DECEMBER, 1896.

STEER FEEDING.

POSTOFFICE:
COLLEGE STATION, BRAZOS CO., TEXAS.

All Reports from this Station are sent free to farmers of the State on application to J. H. CONNELL, DIRECTOR, P. O. College Station, Texas.

AUSTIN:
BEN C. JONES & CO., PRINTERS, AUSTIN.
1897

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TWO STEER FEEDING EXPERIMENTS.

J. H. CONNELL.

J. W. CARSON.

Any suggestions that can be made having a general application, and effecting a saving of a few cents per head in the feeding and management of the thousands of Texas cattle, will amount to a vast sum in the aggregate annually. The Texas Experiment Station has for years devoted a large part of its time and energy to the solution of those problems that affect the welfare of the cattle interests, because it is agreed that this is now the primary livestock investment of the State.[a] Economy in method of beef production lends value and shows a profit finally to the breeder, the grazer, and the trader, no less than to the feeder who prepares the animal for final market. Bulletins numbers 2, 6, and 10, published in 1888, 1889, and 1890, bore upon the value of different stock foods of the State for fattening steers. This line of investigation was continued in 1892 and 1893 and reported on in Bulletin 27, and for the past two feeding seasons we have labored to establish clearly rules for a proper combination of cotton seed meal with cotton seed hulls for best results in fattening steers, as reported on in this publication.[b]

By far the greater part of Texas stallfed steers are fattened on a ration of cotton seed meal and cotton seed hulls. Much diversity of opinion exists as to the best manner of feeding hulls and meal for this purpose,

(*a*) Publications issued by the Texas Experiment Station relating to cattle interests, and now out of print: Bulletin No. 2, "Steer Feeding;" Bulletin No. 3, "Grasses;" Bulletin No. 5, "Creameries in Texas;" Bulletin No. 6, "Steer Feeding;" Bulletin No. 10, "Steer Feeding;" Bulletin No. 12, "Screw Worm;" Bulletin No. 13, "Sorghum;" Bulletin No. 14, "Cotton Seed in Dairy Rations;" Bulletin No. 18, "Liver Flukes;" Bulletin No. 20, "Grasses and Forage Plants;" Bulletin No. 21, "Cotton Seed for Hogs;" Bulletin No. 24, "The Cattle Tick;" Bulletin No. 27, "Steer Feeding;" Bulletin No. 29, "Effect of Cotton Seed on Butter, Tallow, Lard and Suet;" Bulletin No. 30, "Veterinary Science;" Bulletin No. 33, "Fee ling Milk Cows;" Bulletin No. 41, "Steer Feeding."

(*b*) Under this report is included some early studies of steer feeding problems as reported on by this Station in the bulletins now out of print, (See pages 898 to 910). A reprint of some of this matter will enable the reader to compare the results obtained here with several lots of steers under feeding trials, using many of the important foods of the State. Each of these tests throws some clear light upon new beef feeding problems, and when closely compared show results of marked consistency and value.

In another report, soon to be issued, we will discuss the results of the experiments in beef feeding conducted by this Station and by Stations in other States, for the purpose of showing clearly both their practical and scientific value. The report will also include a discussion of the most profitable forage crops grown in the Southwest.

but upon no one point is there so much contrary evidence as that of best proportion of cotton seed meal to cotton seed hulls. This becomes a matter of primary importance when we consider the fact that wasteful feeding has in many cases absorbed the possible profit on a large investment. It is generally conceded that hulls should be fed ad libitum, and a sufficient quantity of meal used with the hulls to create an appetite and cause the animal to feed freely on hulls. But the necessary amount of meal has not been agreed on, and few definite experiments have been planned to test this matter. Practice varies the use of meal from three pounds per day per head to as much as twelve pounds. Some feeders practice heavy meal feeding in the early part of the fattening period, while others prefer to reverse this, and feed the meal freely only while finishing the stock for market. Every man consulted can give fair reasons for the method he pursues, but only in rare cases can weights of cattle be had, weight of feed, proportion of meal to hulls, and cost of ration per steer be obtained. In many cases the waste food has been charged against steers that receive no benefit, and, upon the whole, accurate information may be said to be entirely lacking concerning the *best proportion* in which to mix the meal and hulls.

OBJECTS OF THE EXPERIMENTS.

The two experiments were instituted for the purpose of answering clearly three important questions:

1. **In what proportions should cotton seed meal and hulls be fed for cheapest gain in flesh for long and for short fattening periods?**
2. **What combinations of meal with hulls fed to steers give the largest daily gain in live weight when fed for long and for short periods?**
3. **Can sound meal and hulls be so proportioned or fed as to produce blindness or "fat sickness" in good cattle and with healthful surroundings?**

Very clear answers were received to these questions, and further information was gained as to the amount of feed per day required by steers of one thousand pounds weight to secure satisfactory gains.

PLAN OF EXPERIMENTS.

Feeding experiments, when carefully planned, are always complex, and therefore do not yield clear information and offer nice distinctions to the careless reader. Real study is necessary to bring out differences clearly.

(*1*) *It was our intention to feed to one pen of steers as much hulls as possible, combined with as little meal as we could feed to insure fair appetite. We succeeded in feeding 1 pound of meal to 6.3 pounds of hulls with good results.*

(*2*) *We attempted to reverse this first ration with another pen, and feed as nearly all meal and no hulls as the health of the steers would permit. We succeeded in feeding 1 pound of meal to 1.7 pounds of hulls, and health remained good.*

(*3*) *We also combined the meal and hulls in ordinary proportions of 1 pound meal to 3 or 4 pounds of hulls.*

(*4*) *We tested one pen of steers on a changed ration, beginning with a light ration of meal, and during the middle part of the fattening season changed to a heavy feed of meal—feeding hulls freely and continuously.*

(*5*) *It was thought that "fat sickness" might result from some of the combinations of meal and hulls, and with this object in view the steers were not only fed 120 days, but were kept on full feed for 60 days longer and then turned on pasture.*

THE CATTLE USED

in this test were selected from a bunch of one hundred head of smooth Leon county threes and fours. Nearly all of this stock showed clear Short Horn markings, and while they were not large they were blocky and good feeders. All of the steers had been upon the same range for some weeks before they were taken up, weighed, and assorted. The pens were made up of steers having similar form, age, appetite, and live weight.

THE INITIAL WEIGHTS

were secured by three weights of each steer taken in as many days. All of the stock received regular feeding, watering, and weighing under exactly similar conditions. All steers were dehorned at beginning of test. Each animal was fed separately, and the feed was given as demanded by appetite, but the ration intended for each pen was carefully kept in view and the proportion of meal to hulls was widely different in the several rations.

By reference to pages 893 and 894 of this report the reader will find that in the second experiment the normal ration of meal and hulls (combined in proportion of 1 to 3) gave approximately the same gains per one thousand pounds live weight as did that ration in the first test.

THE "FEEDING PERIOD"

or the time required to prepare cattle for market, necessarily varies with many conditions surrounding the individual lot or "bunch." To definitely fix upon a certain length of time as best suited to the majority of cases is, therefore, entirely arbitrary and unwarranted. The two periods used in this experiment (70 and 120 days) have been chosen as a matter of convenience, and because that on these dates the steers were showing the effects of the feed clearly (in the shorter period) and were fully ripe at the close of the longer period. The reader can, however, refer to the tables shown in these pages and cast up the account against any of the lots or pens under experiment for periods of 80 days, 90, 100, or periods of any desired length. See pp. 888 and 895.

THE FIRST EXPERIMENT was conducted during the winter season of 1894–5. This was followed by another during the next winter, for the purpose of verifying the peculiar results obtained from the first experiments. A glance at the four charts found on succeeding pages will show clearly the prominent results of the two experiments. Each experiment is divided into long and short time periods, thus presenting results in four charts.

FIRST EXPERIMENT.

The conclusions drawn from these experiments are here briefly stated under the head of (1) "*Cheapest Gains*," (2) "*Greatest Gains*," and (3) "*Effect on Health*."

Where the item of cost of food is involved in these conclusions, it must be remembered that the prices stated only are used. The method of calculating the cost of the several rations here shown can be intelligently applied to the prices of foods in any part of the State, and the expected profits can thus be approximately adjusted to local feed market conditions. It is not claimed for these results that all steers when upon these rations under any conditions will gain exactly as did those here reported on, but that the results to be secured will approach these most closely if conditions of cattle, food, prices, and treatment are similar to these stated. It is necessary that the notes here presented bearing on the class of cattle fed, methods of feeding, system of weighing, etc., should be carefully studied.

CHEAPEST GAINS IN 120 DAYS.

THE CHEAPEST POUND

of live weight gained per period was made by pen "D," fed *1 pound of cotton seed meal to 4.8 pounds cotton seed hulls*—(minimum of meal and maximum of hulls). Cost per pound gained, 3.54 cents.

The second cheapest pound gained was from pen "A," fed a changed ration of light meal feed for fifty days and changed to heavy meal with hulls. For details of ration see page 884. Cost per pound gained was 3.88 cents.

THE DEAREST POUND

gained was made by pen "C," on a ration of *nearly equal parts meal and hulls*. Cost per pound gained was 6.51 cents.

REMARKS.—Regardless of the scale of prices here assumed in calculating the cost of rations, the mixture fed pen "D," consisting of a maximum of hulls and a minimum of meal, proved most profitable. (1) If meal is rated at $15 per ton (moderate) and hulls at $3.50 (moderate), the cost of a pound gained from this ration is 3.54 cents. (2) If meal is rated at $12 (low) and hulls at $4 (high), the cost of a pound gained is 3.52 cents. (3) If meal sells at $18 (high) and hulls at $3 (low), the cost of the pound gained is 3.61 cents. While these figures show the cost of the pound gained with this ration to be greater than when these steers "D" were fed for 70 days, it must be borne in mind that their riper conditions adds value to each pound of the body over and above the value of the steers fattened for a short period. Straight steers are valued at 2 cents per pound, half fat at 2¾ cents, and fat at 3 cents.

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EXPERIMENT I.—CHART NO. 1.—(Fed for 120 Days.)

Chart showing relative *gains* and *cost* of live weight *per steer for 120 days.* *

—PEN A.—

Gain: 231 lbs. Ration: 1 lb. C. S. M. to 2.4 lbs. C. S. H.

Cost: $8.97.

—PEN B.—

Gain: 213.5 lbs. Ration: 1 lb. C. S. M. to 2.9 lbs. C. S. H.

Cost: $9.04

—PEN C.—

Gain: 117.5 lbs. Ration: 1 lb. C. S. M. to 1.7 lbs. C. S. H.

Cost: $7.65.

—PEN D.—

Gain: 214 lbs. Ration: 1 lb. C. S. M. to 4.8 lbs. C. S. H.

Cost: $7.59.

* NOTE.—(a) Each inch represents 33⅓ lbs. gain in live weight.
(b) Each inch represents $3.00 worth of food eaten.

EXPERIMENT I.—CHART NO. 2.—(Fed for 70 Days.)

Chart showing relative *gains* and *cost* of live weight *per steer for 70 days.* *

—PEN A.—

Gain: 146 lbs. Ration: 1 lb. C. S. M. to 3.2 lbs. C. S. H.

Cost: $4.74.

—PEN B.—

Gain: 146 lbs. Ration: 1 lb. C. S. M. to 3.12 lbs. C. S. H.

Cost: $5.34.

—PEN C.—

Gain: 92.5 lbs. Ration: 1 lb. C. S. M. to 1.6 lbs. C. S. H.

Cost: $4.81.

—PEN D.—

Gain: 159 lbs. Ration: 1 lb. C. S. M. to 5.1 lbs. C. S. H.

Cost: $4.61.

* NOTE.—(a) Each inch represents 33⅓ lbs. gain in live weight.
(b) Each inch represents $3.00 worth of food eaten.

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EXPERIMENT II.—CHART NO. 1.—(Fed for 120 Days.)

Chart showing relative *gains* and *cost* of live weight *per steer for 120 days.* *

—PEN A.—

Gain: 175.3 lbs. Ration: 1 lb. C. S. M. to 1.5 lbs. C. S. H.

Cost: $11.38.

—PEN B.—

Gain: 239.6 lbs. Ration: 1 lb. C. S. M. to 6.5 lbs. C. S. H.

Cost: $8.59.

—PEN C.—

Gain: 239.6 lbs. Ration: 1 lb. C. S. M. to 3.1 lbs. C. S. H.

Cost: $10.90.

* NOTE.—(a) Each inch represents 33⅓ lbs. gain in live weight.
(b) Each inch represents $3.00 worth of food eaten.

EXPERIMENT II.—CHART NO. 2.—(Fed for 80 Days.)

Chart showing relative *gains* and *cost* of live weight *per steer for 80 days.* *

—PEN A.—

Gain: 152 lbs. Ration: 1 lb. C. S. M. to 1.4 lbs. C. S. H.

Cost: $8.54.

—PEN B.—

Gain: 175.6 lbs. Ration: 1 lb. C. S. M. to 6.3 lbs. C. S. H.

Cost: $5.75.

—PEN C.—

Gain: 194.6 lbs. Ration: 1 lb. C. S. M. to 3.5 lbs. C. S. H.

Cost: $7.36.

* NOTE.—(a) Each inch represents 33⅓ lbs. gain in live weight.
(b) Each inch represents $3.00 worth of food eaten.

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CHEAPEST GAINS IN 70 DAYS.

THE CHEAPEST POUND

of live weight gained per period was by pen "D," *fed 1 pound cotton seed meal to 5.1 pounds cotton seed hulls* (minimum of meal and maximum of hulls). Cost per pound gained was 2.89 cents.

The second cheapest pound gained was from pen "A," fed a changed ration averaging for the period of 70 days 1 pound of cotton seed meal to 3.2 pounds of cotton seed hulls. Cost per pound gained was 3.24 cents.

THE DEAREST POUND

gained was from pen "C," fed a ration of *1 pound cotton seed meal to 1.6 pounds cotton seed hulls.* Cost per pound gained was 4.95 cents.

REMARKS.—If the prices of the foods be varied and calculated for as shown in tables on page 884 and following, the relative position of the rations for first place will not be materially changed. Thus: (1) If meal is valued at $15 per ton and hulls at $3.50, the greatest profit is realized from a ration of 1 pound meal to 5.1 pounds hulls, producing 1 pound gained at 2.89 cents. (2) If meal be valued at $12 and hulls at $4, the same proportion of meal and hulls stands first at a cost of 2.86 cents per pound gained. (3) If meal be valued at $18 and hulls at $3, the ration "D" still holds first place, producing a pound of gain at cost of 2.93 cents. See page 888, Pen D.

We are, therefore, forced to the conclusion that the steers fed returned a greater profit when fed 1 pound of meal to about 5 pounds of hulls than when fed less hulls in proportion to meal. This conclusion applies to both 70 and 120 days fattening periods. It will also prove true if other probable prices than those assumed be used in calculating the cost. See also results of experiment II.*

GREATEST GAINS IN 120 DAYS.

THE GREATEST GAIN

made by any pen was from steers fed a "changed ration," composed of *1 pound cotton seed meal to 2.4 pounds cotton seed hulls.* Cost of ration *per head* for period was $8.97; gain per steer for period was 231 pounds. See Pen "A."

The next greatest gain was made from a ration composed of *1 pound cotton seed meal to 4.8 pounds cotton seed hulls* (pen "D"). This was a minimum of meal and a maximum of hulls. Cost of ration per head for period was $7.59; gain per steer for period was 214 pounds.

THE LEAST GAIN

was made in pen "C," fed a ration composed of *1 pound cotton seed meal to 1.7 pounds of cotton seed hulls* (nearly equal parts meal and

* Grass cattle are rated in the tables at 2 cents per pound on foot. Steers fed 120 days are valued at 3 cents per pound, and half-fat steers at 2¾ cents.

hulls). Cost of ration per head for period, $7.64. Quantity eaten indicated good appetite and health. Gain per steer for period was only 117½ pounds.

GREATEST GAINS IN 70 DAYS.

THE GREATEST GAIN

was made by pen "D," fed a ration of *1 pound cotton seed meal to 5.1 pounds cotton seed hulls.* (A minimum of meal and a maximum of hulls.) Cost of ration per head for period was $4.61. Gain per steer for period was 159 pounds.

Second best gain was made by pens "A" and "B," fed rations of *1 pound cotton seed meal to 3.20 pounds hulls.* Both pens made gains of 146 pounds per head during period. Ration per steer for pen "A" cost $4.74 per period, while that for pen "B" cost $5.34.

THE LEAST GAIN

was made by pen "C," from a ration consisting of *1 pound cotton seed meal to 1.6 pounds cotton seed hulls.* Cost of ration per head for period was $4.81. Gain per steer for period was only 92.5 pounds.

REMARKS.—It is highly important that the reader examine closely the meaning of the results obtained from these short periods of feeding. It is evident that those rations that showed quickest results upon the body gain of the animal will be found most marked and prominent in this "70-day period." If fed for a period as long as 120 days, it may happen that the best rations will ripen steers at 100 days, and steers will continue to eat for 20 days without showing satisfactory returns in live weight gained. This tendency was clearly observed in some of the cattle under test and reported on.

Ordinarily, a thin but healthy steer is expected to make the largest daily live weight gain during the first half of the feeding trial, but we should bear in mind the fact that these early gains are somewhat deceptive, because a large per cent of such gain is merely paunch and intestinal load carried by the full fed animal. Just where the line should be drawn between real and apparent flesh gains (live weight) cannot be exactly stated, as many inspections of carcass are necessary to demonstrate this matter with any degree of clearness for a particular breed. But, regardless of this matter, we should bear in mind the fact that the cost of a pound gain in flesh is relatively higher the further we feed beyond the half-fat condition.

An inspection of the following tables will bring out more clearly the objects aimed at in the above remarks. In footing up the gains of pen "D" for 70 days, we find that a gain of *159 pounds per head* was made on a ration of 1 pound cotton seed meal to 5.1 pounds hulls. This was the largest gain per head made by any pen for 70 days. But pen "A" gave larger yields for the latter portion of the 120-day period than did pen "D," although it was made at greater cost per pound, etc. These tables show the weight of the steers reported, their gains, feed consumed, cost of fed steer, profit per head, average gain per head and per hundred weight, and cost of each pound gained during the first 70 days and the 120 days test reported on under Statement I.

EFFECT ON HEALTH.

In some cases cattle fattened on cotton seed meal and cotton seed hulls have sickened and died as a result of the ration. This abnormal result is known among feeders as "fat sickness," and is often accompanied by inflamation of the eye or total loss of sight. This trouble is not frequently met with, but seems most prevalent during certain seasons. For years a case may not be noticed among thousands of cattle fed a hull and cotton seed meal diet, while during other seasons a large percent of certain bunches are affected.

The thrifty fat cattle are most subject to this trouble, and it has been stated by some reliable feeders that fattening cattle upon hulls and meal and then turning them upon pasture had invariably resulted in "fat sickness," in their experience and observation. Some have attributed this trouble to a damaged or spoiled condition of the foods used; others have assumed that indigestion was the cause; and others still have explained it upon the theory of mal-nutrition.

It was expected that under the varying rations of hulls and meal, the extended fattening period, and the warm weather prevailing during the close of the feeding period, some abnormal and unhealthy results would develop in some of the twenty-eight steers under experiment. But no sickness occurred at any time, if we except the passing attacks of indigestion resulting from feeding an excess of cotton seed meal to some of the pens of steers. It should be stated in this connection that no cases of sickness in hull and meal cattle were reported in this section during either of the feeding seasons here referred to.

FIRST EXPERIMENT: WINTER 1894-95.

STATEMENT I—120 DAYS.

PEN "A." TWO STEERS: Fed minimum meal and maximum hulls for 50 days, and maximum meal and minimum hulls for 70 days. (*Ration: 1 pound cotton seed meal to 2.4 pounds hulls for 120 days.*)

Consumed per head in 120 days:

(1)*	761.4 pounds cotton seed meal at $15 per ton..	$5 71	
	1862.9 pounds cotton seed hulls at $3.50 per ton	3 26	$8 97
(2)	761.4 pounds cotton seed meal at $18 per ton..	6 85	
	1862.9 pounds cotton seed hulls at $3 per ton..	2 79	9 64
(3)	761.4 pounds cotton seed meal at $12 per ton..	4 57	
	1862.9 pounds cotton seed hulls at $4 per ton..	3 72	8 29
Average total cost of feed			$8 97
Average weight of steers at beginning of experiment, 764 pounds at 2 cents			$15 28
Total cost of steers per head after feeding			$24 25
Average weight of steers after feeding, 995 pounds at 3 cents.			$29 85
Profit and to pay labor, per head			$5 60
Average gain per head, pounds		231	
Gain per hundred weight, pounds		30.2	
Cost of food for each pound gained, cents		3.88	

Average daily ration per head, 6.34 pounds cotton seed meal, 15.52 pounds cotton seed hulls.

PEN "B." TWO STEERS: Fed "normal ration" of meal and hulls *ad libitum.* (*Ration 1 pound of cotton seed meal to 2.9 pounds hulls.*)

Consumed per head 120 days:

(1)	706.4 pounds cotton seed meal at $15 per ton..	$5 30	
	2139.8 pounds cotton seed hulls at $3.50 per ton.	3 74	$9 04
(2)	706.4 pounds cotton seed meal at $18 per ton..	6 36	
	2139.8 pounds cotton seed hulls at $3 per ton...	3 17	9 53
(3)	706.4 pounds cotton seed meal at $12 per ton..	4 24	
	2139.8 pounds cotton seed hulls at $4 per ton...	4 23	8 47
Average total cost of feed per head			$9 04
Average weight of steers at beginning of experiment, 754 pounds at 2c			15 08
Total cost of steers per head after feeding			24 12
Average weight of steers after feeding, 967.5 pounds at 3c			29 02
Profit and to pay labor, per head			$4 90
Average gain per head, pounds		213.5	
Gain per hundred weight, pounds		28.3	
Cost of food for each pound gained, cents		4.23	

Daily ration per head averaged 5.88 pounds cotton seed meal and 17.83 pounds cotton seed hulls.

*For the purpose of showing the effect of variable cost of foods upon the rations used, we have assumed three cases: (1) When prices of meal and hulls are moderate ($15 and $3.50 per ton respectively); (2) When meal is high ($18 per ton) and hulls are low ($3 per ton); (3) When meal is low ($12 per ton) and hulls are high ($4 per ton).

PEN "C." TWO STEERS: Fed maximum of meal and minimum of hulls. (*Ration: 1 pound cotton seed meal to 1.7 pounds hulls.*)

Consumed per head in 120 days:

(1)	717.7 pounds cotton seed meal at $15 per ton..	$5 38	
	1293 pounds cotton seed hulls at $3.50 per ton .	2 26	$7 64
(2)	717.7 pounds cotton seed meal at $18 per ton ..	6 46	
	1293 pounds cotton seed hulls at $3 per ton ...	1 94	8 40
(3)	717.7 pounds cotton seed meal at $12 per ton..	4 30	
	1293 pounds cotton seed meal at $4 per ton....	2 59	6 89

Average total cost of feed per head	$7 64
Average weight of steers at beginning of experiment, 762.5 pounds, at 2 cents	15 25
Total cost of steers per head after feeding	$22 89
Average weight of steers after feeding, 880 pounds, at 3 cents	26 40
Profit and to pay labor, per head	$3 51

Average gain per head, pounds	117.5
Gain per cwt, pounds	14.7
Cost of food for each pound gained, cents	6.51

Daily ration per head averaged 5.98 pounds cotton seed meal and 10.77 pounds cotton seed hulls.

PEN "D." TWO STEERS: Fed minimum of meal and maximum of hulls. (*Ration: 1 pound of cotton seed meal to 4.8 pounds cotton seed hulls.*)

Consumed per head in 120 days.

(1)	480 pounds cotton seed meal at $15 per ton....	$3 60	
	2283 pounds of cotton seed hulls at $3.50 per ton	3 99	$7 59
(2)	480 pounds cotton seed meal at $18 per ton....	4 32	
	2283 pounds of cotton seed hulls at $3 per ton..	3 42	7 74
(3)	480 pounds cotton seed meal at $12 per ton....	2 88	
	2283 pounds of cotton seed hulls at $4 per ton..	4 56	7 44

Average total cost of feed per head	$7 59
Average weight of steers at beginning of experiment, 756 pounds at 2 cents	15 12
Total cost of steers per head after feeding	$22 71
Average weight of steers after feeding, 970 pounds at 3 cents,	29 10
Profit and to pay labor, per head	$6 39

Average gain per head, pounds	214
Gain per hundred weight, pounds	28.3
Cost of food for each pound gained, cents	3.54

Daily ration per head averaged 4 pounds cotton seed meal and 19.02 pounds cotton seed hulls.

STATEMENT II—70 DAYS.*

PEN "A." TWO STEERS: Fed "normal" quantities of meal and hulls. (*Ration: 1 pound cotton seed meal to 3.2 pounds cotton seed hulls.*)

Consumed per head in 70 days:

(1)	361.4 pounds cotton seed meal at $15 per ton..	$2 71	
	1162.9 pounds cotton seed hulls at $3.50 per ton	2 03	$4 74
(2)	361.4 pounds cotton seed meal at $18 per ton..	3 25	
	1162.9 pounds cotton seed hulls at $3 per ton..	1 74	4 99
(3)	361.4 pounds cotton seed meal at $12 per ton..	2 17	
	1162.9 pounds cotton seed hulls at $4 per ton..	2 32	4 49
Average total cost of feed per head			$4 74
Average weight of steers at beginning of experiment, 764 pounds, at 2 cents			15 28
Total cost of steers per head after feeding			$20 02
Average weight of steers after feeding, 910 pounds, at 2.75c..			25 02
Profit and to pay labor, per head			$5 00
Average gain per head, pounds		146	
Gain per cwt., pounds		19.1	
Cost of food for each pound gained, cents		3.24	

† *Daily ration per head averaged 5.16 pounds cotton seed meal and 16.61 pounds cotton seed hulls.*

PEN "B." TWO STEERS: Fed "normal" amounts of meal and hulls ad libitum. (*Ration: 1 pound cotton seed meal to 3.2 pounds cotton seed hulls.*)

Consumed per head in 70 days:

(1)	409.7 pounds cotton seed meal at $15 per ton...	$3 07	
	1298 pounds cotton seed hulls at $3.50 per ton..	2 27	$5 34
(2)	409.7 pounds cotton seed meal at $18 per ton...	3 69	
	1298 pounds cotton seed hulls at $3 per ton	1 94	5 63
(3)	409.7 pounds cotton seed meal at $12 per ton...	2 46	
	1298 pounds cotton seed hulls at $4 per ton	2 59	5 05
Average total cost of feed per head			$5 34
Average weight of steers at beginning of experiment, 754 pounds at 2c			15 08
Total cost of steers per head after feeding			$20 42
Average weight of steers after feeding, 900 pounds at 2.75c...			24 75
Profit and to pay labor, per head			$4 33
Average gain per head, pounds		146	
Gain per hundred weight, pounds		19.36	
Cost of food for each pound gained, cents		3.68	

Daily ration per head averaged 5.85 pounds cotton seed meal and 18.90 pounds cotton seed hulls.

*The results of the 70-day test can be more closely studied by referring to the summarized statement of feeding by 10-day periods found on pages 888 and 889.

†This ration was revised for the latter portion of the 120-day fattening period. (See pp. 884 and 888.)

PEN "C." TWO STEERS: Fed maximum meal, minimum hulls. (*Ration: 1 pound cotton seed meal to 1.6 cotton seed hulls.*)

Consumed per head in 70 days:			
(1)	467 pounds cotton seed meal at $15 per ton	$3 50	
	751.5 pounds cotton seed hulls at $3.50 per ton	1 31	$4 81
(2)	467 pounds cotton seed meal at $18 per ton	4 20	
	751.5 pounds cotton seed hulls at $3 per ton	1 13	5 33
(3)	467 pounds cotton seed meal at $12 per ton	2 80	
	751.5 pounds cotton seed hulls at $4 per ton	1 50	4 30
Average total cost of feed per head			$4 81
Average weight of steers at beginning of experiment, 762.5 pounds, at 2 cents			15 25
Total cost of steers per head after feeding			20 06
Average weight of steers after feeding, 855 pounds at 2.75c.			23 51
Profit and to pay labor, per head			$3 45
Average gain per head, pounds		92.5	
Gain per cwt., pounds		12.1	
Cost of food for each pound gained, cents		4.95	

Daily ration per head averaged 6.67 pounds cotton seed meal and 10.73 pounds cotton seed hulls.

PEN "D." TWO STEERS: Fed minimum meal and maximum hulls. (*Ration: 1 pound cotton seed meal to 5.1 cotton seed hulls.*)

Consumed per head in 70 days.			
(1)	280 pounds cotton seed meal at $15 per ton	$2 10	
	1437.5 pounds cotton seed hulls at $3.50 per ton	2 51	$4 61
(2)	280 pounds cotton seed meal at $18 per ton	2 52	
	1437.5 pounds cotton seed hulls at $3 per ton	2 15	4 67
(3)	280 pounds cotton seed meal at $12 per ton	1 68	
	1437.5 pounds cotton seed hulls at $4 per ton	2 87	4 55
Average total cost of feed per head			$4 61
Average weight of steers at beginning of experiment, 756 pounds, at 2 cents			15 12
Total cost of steers after feeding			$19 73
Average weight of steers after feeding, 915 pounds at 2.75c.			25 16
Profit and to pay labor, per head			$5 43
Average gain per head, pounds		159	
Gain per hundred weight, pounds		21	
Cost of food for each pound gained, cents		2.89	

Daily ration per head averaged 4 pounds cotton seed meal and 20.54 pounds cotton seed hulls.

EXPERIMENT I.

PEN "A;" 2 STEERS; FED 120 DAYS.

(Ration, 1 pound C. S. M. to 2.4 pounds C. S. H.)

Ten day period.	Pounds *Cotton Seed Meal.	Cost.	Pounds †Cotton Seed Hulls.	Cost.	Pounds Gained.	Pounds Lost.
Dec. 1 to 10, inclusive	80	$0 60	352.5	$0 62	17	
Dec. 11 to 20, inclusive	80	60	409.1	72	50	
Dec. 21 to 30, inclusive	80	60	401.1	70	25	
Dec. 31 to Jan. 9, inclusive	80	60	397.7	70	105	
Jan. 10 to 19, inclusive	80	60	316.4	55	.....	85
Jan. 20 to 29, inclusive	162.8	1 22	169	30	135	
Jan. 30 to Feb. 8, inclusive	160	1 20	280	49	45	
Feb. 9 to 18, inclusive	160	1 20	280	49	.....	
Feb. 19 to 28, inclusive	160	1 20	280	49	45	
March 1 to 10, inclusive	160	1 20	280	49	75	
March 11 to 20, inclusive	160	1 20	280	49	25	
March 21 to 30, inclusive	160	1 20	280	49	25	
Total	1522.8	$11 42	3725.8	$6 53	547 85	85
Net gain	.....	.....	.....	.....	462	

* At $15 per ton. † At $3.50 per ton.

Cost of food for each pound gained, 3.88 cents.

PEN "B;" 2 STEERS; FED 120 DAYS.

(Ration, 1 pound C. S. M. to 2.9 pounds C. S. H.)

Ten day period.	Pounds *Cotton Seed Meal.	Cost.	Pounds †Cotton Seed Hulls.	Cost.	Pounds Gained.	Pounds Lost.
Dec. 1 to 10, inclusive	116.3	$0 87	322.2	$0 56	17	
Dec. 11 to 20, inclusive	116.2	87	386.3	68	25	
Dec. 21 to 30, inclusive	113.9	85	389.1	68	100	
Dec. 31 to Jan. 9, inclusive	120	90	388	68	15	
Jan. 10 to 19, inclusive	120	90	392	68	60	
Jan. 20 to 29, inclusive	120	90	359	63	85	
Jan. 30 to Feb. 8, inclusive	113	85	409.5	72	.....	10
Feb. 9 to 18, inclusive	115	86	338.5	59	20	
Feb. 19 to 28, inclusive	119.5	90	330	58	.....	20
March 1 to 10, inclusive	119	89	325	57	90	
March 11 to 20, inclusive	120	90	336	59	20	
March 21 to 30, inclusive	120	90	304	53	25	
Total	1412.9	$10 59	4279.6	$7 49	457 30	30
Net gain	.....	.....	.....	.....	427	

* At $15 per ton. † At $3.50 per ton.

Cost of food for each pound gained, 4.23 cents.

PEN "C;" 2 STEERS; FED 120 DAYS.

(Ration, 1 pound C. S. M. to 1.7 pounds C. S. H.)

Ten day period.	Pounds *Cotton Seed Meal.	Cost.	Pounds †Cotton Seed Hulls.	Cost.	Pounds Gained.	Pounds Lost.
Dec. 1 to 10, inclusive	139.5	$1 05	160	$0 28	.....	50
Dec. 11 to 20, inclusive	158.7	1 19	216	38	115	
Dec. 21 to 30, inclusive	132.9	1 00	240	42	35	
Dec. 31 to Jan. 9, inclusive	138.4	1 04	240	42	70	
Jan. 10 to 19, inclusive	121.3	91	220	39	.....	40
Jan. 20 to 29, inclusive	138.5	1 04	218	38	95	
Jan. 30 to Feb. 8, inclusive	104.8	79	209	37	.....	30
Feb. 9 to 18, inclusive	123	92	242	42	15	
Feb. 19 to 28, inclusive	108.5	81	216	38	.....	15
March 1 to 10, inclusive	90.5	68	197	34	40	
March 11 to 20, inclusive	92.5	69	235	41	30	
March 21 to 30, inclusive	87	65	193	34	.....	30
Total	1435.6	$10 77	2586	$4 53	400 165	165
Net gain					235	

* At $15 per ton. † At $3.50 per ton.

Cost of food for each pound gained, 6.51 cents.

PEN "D;" 2 STEERS; FED 120 DAYS.

(Ration, 1 pound C. S. M. to 4.8 pounds C. S. H.)

Ten day period.	Pounds *Cotton Seed Meal.	Cost.	Pounds †Cotton Seed Hulls.	Cost.	Pounds Gained.	Pounds Lost.
Dec. 1 to 10, inclusive	80	$0 60	401	$0 70	53	
Dec. 11 to 20, inclusive	80	60	422	74	65	
Dec. 21 to 30, inclusive	80	60	392.6	68	60	
Dec. 31 to Jan. 9, inclusive	80	60	359.8	63	30	
Jan. 10 to 19, inclusive	80	60	429.7	75	55	
Jan. 20 to 29, inclusive	80	60	430.9	75	55	
Jan. 30 to Feb. 8, inclusive	80	60	439.1	77	.....	
Feb. 9 to 18, inclusive	80	60	373	65	.....	40
Feb. 19 to 28, inclusive	80	60	346	60	35	
March 1 to 10, inclusive	80	60	320	56	75	
March 11 to 20, inclusive	80	60	339	59	.....	
March 21 to 30, inclusive	80	60	313	55	40	
Total	960	$7 20	4566.1	$7 97	468 40	40
Net gain	.....	.....	.....	.....	428	

* At $15 per ton. † At $3.50 per ton.

Cost of food for each pound gained, 3.54 cents.

SECOND EXPERIMENT.

In duplicating the work of the preceding winter we were fully as careful in the selection of steers for the feeding trial, and the results were in almost perfect harmony with those secured during the winter of 1894–5.

The Steers used were selected from a bunch of 100 Brazoria county fours and up. The individual steers were much larger than the Leon county stock used the preceding winter, and were unlike them in form and color markings. All of the Brazoria cattle were tall, "rangy" steers, frequently known as the "Shanghai type." They were hardy and fattened profitably under good conditions. In killing these steers the presence of liver flukes (*distomum hepaticum*) was very noticeable. All of the steers were quite wild and had been upon the same range for some months before the feeding trial began. The experiment was not begun until all of the cattle had been broken to small enclosure and had begun eating freely.

The conclusions drawn from the second experiment are here distinctly stated under the three heads, "Cheapest Gains," "Greatest Gains," and "Effect on Health," as was the case in our discussion of the first experiment, reported on in these pages.

CHEAPEST GAINS IN 120 DAYS.

THE CHEAPEST POUND

of live weight gained per period was made from the ration combining the *minimum of meal with the maximum of hulls* as fed to pen "B." Cost per pound gained 3.58 cents. Cost per head per 120 days $8.59.

The next cheapest pound gained was from the normal ration of hulls and meal fed pen "C." Cost per pound gained 4.55 cents. Cost per head for 120 days $10.90.

THE GREATEST COST PER POUND

of live weight gain was from pen "A," fed a ration consisting of *maximum amount of meal and minimum amount of hulls*. Cost per pound gained 6.49 cents. Cost per head per 120 days, $11.38.

REMARKS: The meal and hulls fed to pen "B" were in proportion of 1 pound meal to 6.4 pounds hulls. It will be noted that this is practically the same combination of meal and hulls as were fed pen "D" the preceding year and reported upon page 885. It is also equally evident from this experiment that an *increase of cotton seed meal beyond the point of 1 pound cotton seed meal to some 5 pounds of hulls* is usually a waste of a costly stock food.

GREATEST GAINS.

THE GREATEST GAIN

per day was made by the steers fed the ration of 1 pound meal to 6.4 pounds hulls. See statement for pen "B."

THE NEXT GREATEST GAIN

was from the normal ration fed pen "C:" 1 pound cotton seed meal to 3.4 pounds cotton seed hulls.

THE LEAST GAIN

was from the heavy meal ration of 1 pound meal to 1.5 pounds hulls as fed to pen "A" for 120 days.

EFFECT ON HEALTH.

In no case did the steers under experiment appear to be sick, though at times the pen fed the larger proportion of meal to hulls lost appetite. By reference to page 895 it will be noted that for ten days at a time these steers made no gains, indicating the disturbed condition of the digestive system.

At no time did blindness or symptoms of fat sickness appear. The loss of appetite above referred to seemed to be due entirely to passing attacks of indigestion caused by a very heavy grain ration, consisting of cotton seed meal, which is known to be very laxative. For a short while, as much as 17 pounds of cotton seed meal was fed per day to the steers in pen "A," without unusual results.

THE STATEMENTS

here presented are accurate accounts of how much was eaten, and show the resulting gain or loss clearly for each pen for 120-day fattening period and an 80-day period. The reader is referred to page 895 for a summarized statement of the progress of steers by 10-day periods.

SECOND EXPERIMENT: WINTER 1895-96.

STATEMENT I—120 DAYS.

PEN "A." THREE STEERS: (*Fed meal and hulls in proportion of 1 to 1.5.*)

Consumed per head in 120 days:

(1)	1125.6 pounds cotton seed meal at $15 per ton.	$8 44	
	1681 pounds cotton seed hulls at $3.50 per ton.	2 94	$11 38
(2)	1125.6 pounds cotton seed meal at $18 per ton.	10 13	
	1681 pounds cotton seed hulls at $3 per ton....	2 52	12 65
(3)	1125.6 pounds cotton seed meal at $12 per ton.	6 75	
	1681 pounds cotton seed hulls at $4 per ton....	3 36	10 11
Average total cost of feed per head.....			$11 38
Average weight of steers at beginning of experiment, 992 pounds, at 2 cents.....			19 84
Total cost of steers after being fattened.....			$31 22
Weight of steers after feeding 1167.3 pounds at 3 cents			35 02
Profit and to pay labor, per head.....			$3 80
Average gain per head, pounds.....		175.3	
Gain per cwt., pounds		17.67	
Cost of food for each pound gained, cents.....		6.49	

Average daily ration per head 9.38 pounds cotton seed meal and 14 pounds cotton seed hulls.

PEN "B." THREE STEERS: (*Fed meal and hulls in proportion of 1 to 6.4.*)

Consumed per head in 120 days:

(1)	456.6 pounds cotton seed meal at $15 per ton..	$3 42	
	2958 pounds cotton seed hulls at $3.50 per ton	5 17	$8 59
(2)	456.6 pounds cotton seed meal at $18 per ton..	4 11	
	2958 pounds cotton seed hulls at $3 per ton....	4 49	8 60
(3)	456.6 pounds cotton seed meal at $12 per ton..	2 74	
	2958 pounds cotton seed hulls at $4 per ton....	5 99	8 73
Average total cost of feed per head..... ...			$8 59
Average weight of steers at beginning of experiment, 994.3 pounds, at 2 cents.....			19 88
Total cost of steers after being fattened			$28 48
Average weight of steers after feeding, 1233.9 pounds, at 3 cents.....			37 01
Profit and to pay labor, per head			$8 53
Average gain per head, pounds		239.6	
Gain per cwt., pounds.....		24.09	
Cost of food for each pound gained, cents.....		3.58	

Average daily ration per head, cotton seed meal 3.8 pounds, and 24.65 pounds cotton seed hulls.

PEN "C." THREE STEERS: (*Fed meal and hulls in proportion of 1 to 3.4.*)

Consumed per head in 120 days.

(1)	847.8 pounds cotton seed meal at $15 per ton ..	$6 36	
	2601.3 pounds cotton seed hulls at $3.50 per ton	4 54	$10 90
(2)	847.8 pounds cotton seed meal at $18 per ton..	7 63	
	2601.3 pounds cotton seed hulls at $3 per ton..	3 90	11 53
(3)	847.8 pounds cotton seed meal at $12 per ton..	5 09	
	2601.3 pounds cotton seed hulls at $4 per ton...	5 20	10 29

Average total cost of feed per head.....	$10 90
Average weight of steers at beginning of experiment, 1022 pounds, at 2 cents.....	20 44
Total cost of steers after being fattened	$31 34
Weight of steers after feeding, 1261.6 pounds, at 3 cents.....	37 85
Profit and to pay labor, per head.....	$6 51

Average gain per head, pounds	239.6
Gain per hundred weight, pounds.....	23.44
Cost of food for each pound gained, cents	4.55

Average daily ration per head 7.06 pounds cotton seed meal and 21.67 pounds cotton seed hulls.

SECOND EXPERIMENT: WINTER 1895-96.

STATEMENT II—80 DAYS.

PEN "A." THREE STEERS: (*Fed meal and hulls in proportion of 1 to 1.4.*)

Consumed per head in 80 days:

(1)	859.4 pounds cotton seed meal at $15 per ton..	$6 44	
	1198.8 pounds cotton seed hulls at $3.50 per ton	2 10	$8 54
(2)	859.4 pounds cotton seed meal at $18 per ton..	7 73	
	1198.8 pounds cotton seed hulls at $3 per ton..	1 80	9 53
(3)	859.4 pounds cotton seed meal at $12 per ton..	5 16	
	1198.8 pounds cotton seed hulls at $4 per ton..	2 39	7 55

Average total cost of feed per head.....	$8 54
Average weight of steers at beginning of experiment, 992 pounds, at 2 cents	19 84
Total cost of steers after being fattened.....	$28 38
Average weight of steers after feeding, 1144 pounds, at 2.75c	31 46
Profit and to pay labor, per head.....	$3 08

Average gain per head, pounds	152
Gain per cwt., pounds.....	15.32
Cost of food for each pound gained, cents.....	5.62

Average daily ration 10.74 pounds cotton seed meal and 14.98 pounds cotton seed hulls.

PEN "B." THREE STEERS: (*Fed meal and hulls in proportion of 1 to 6.5.*)

Consumed per head in 80 days:

(1)	304.1 pounds cotton seed meal at $15 per ton..	$2 28	
	1978.3 pounds cotton seed hulls at $3.50 per ton	3 46	$5 74
(2)	304.1 pounds cotton seed meal at $18 per ton..	2 74	
	1978.3 pounds cotton seed hulls at $3 per ton..	2 97	5 71
(3)	304.1 pounds cotton seed meal at $12 per ton..	1 83	
	1978.3 pounds cotton seed hulls at $4 per ton..	3 95	5 78
Average total cost of feed per head			$5 74
Average weight of steers at beginning of experiment, 994.3 pounds, at 2 cents			19 98
Total cost of steers after being fattened			$25 72
Weight of steers after feeding, 1169 pounds, at 2.75 cents			32 07
Profit and to pay labor, per head			$6 35
Average gain per head, pounds		175.6	
Gain per cwt., pounds		17.67	
Cost of food for each pound gained, cents		3.27	

Average daily ration, 3.8 pounds cotton seed meal and 24.72 pounds cotton seed hulls.

PEN "C." THREE STEERS: (*Fed meal and hulls in proportion of 1 to 3.1.*)

Consumed per head in 80 days.

(1)	569.7 pounds cotton seed meal at $15 per ton..	$4 27	
	1769 pounds cotton seed hulls at $3.50 per ton	3 09	$7 36
(2)	569.7 pounds cotton seed meal at $18 per ton..	5 13	
	1769 pounds cotton seed hulls at $3 per ton....	2 65	7 78
(3)	569.7 pounds cotton seed meal at $12 per ton..	3 42	
	1769 pounds cotton seed hulls at $4 per ton....	3 53	6 95
Average total cost of feed per head			$7 36
Average weight of steers at beginning of experiment, 1022 pounds, at 2 cents			20 44
Total cost of steers after being fattened			$27 80
Weight of steers after feeding, 1216.6 pounds, at 2.75 cents..			33 45
Profit and to pay labor, per head			$5 65
Average gain per head, pounds		194.6	
Gain per hundred weight, pounds		19.04	
Cost of food for each pound gained, cents		3.78	

Average daily ration per head 7.12 pounds cotton seed meal and 22.11 pounds cotton seed hulls.

EXPERIMENT II.

PEN "A;" 3 STEERS; FED 120 DAYS.

(Ration, 1 pound C. S. M to 1 5 pounds C. S. H.)

Ten day period.	Pounds *Cotton Seed Meal.	Cost.	Pounds †Cotton Seed Hulls.	Cost.	Pounds Gained.	Pounds Lost.
Dec. 4 to 13, inclusive	290. 75	$2 18	350	$0 61	.....	17
Dec. 14 to 23, inclusive	315. 5	2 37	428. 25	75	145	
Dec. 24 to Jan. 2, inclusive	340. 5	2 55	472. 5	83	134	
Jan. 3 to 12, inclusive	345. 5	2 59	518. 75	91	21	
Jan. 13 to 22, inclusive	341	2 56	486. 4	85	70	
Jan. 23 to Feb. 1, inclusive	349. 75	2 62	497. 2	87	82	
Feb. 2 to 11, inclusive	324. 5	2 43	476. 3	83	28	
Feb. 12 to 21, inclusive	270. 5	2 03	368. 7	64	.....	13
Feb. 22 to March 2, inclusive	204. 5	1 53	325. 1	57	.....	33
March 3 to 12, inclusive	189	1 42	305. 5	53	9	
March 13 to 22, inclusive	186. 5	1 40	349. 4	61	32	
March 23 to April 1, inclusive	219	1 64	467. 7	82	59	
Total	3377	$25 32	5045. 8	$8 82	580	57
					57	
Net gain					523	

Cost of food for each pound gained, 6.49 cents.

PEN "B;" 3 STEERS; FED 120 DAYS.

(Ration, 1 pound C. S. M. to 6.3 pounds C. S. H.)

Ten day period.	Pounds *Cotton Seed Meal.	Cost.	Pounds †Cotton Seed Hulls.	Cost.	Pounds Gained.
Dec. 4 to 13, inclusive	94. 5	$0 71	618	$1 08	57
Dec. 14 to 23, inclusive	102	76	703. 20	1 23	135
Dec. 24 to Jan. 2, inclusive	115	86	725. 75	1 27	85
Jan. 3 to 12, inclusive	113. 5	85	745. 75	1 30	45
Jan. 13 to 22, inclusive	115. 75	86	799. 8	1 40	81
Jan. 23 to Feb. 1, inclusive	125. 5	94	800. 25	1 40	76
Feb. 2 to 11, inclusive	126	94	779. 75	1 36	23
Feb. 12 to 21, inclusive	121. 75	91	752	1 32	15
Feb. 22 to March 2, inclusive	121. 25	91	778. 25	1 36	70
March 3 to 12, inclusive	103. 25	77	649. 75	1 14	5
March 13 to 22, inclusive	119	89	788. 50	1 38	103
March 23 to April 1, inclusive	112. 25	84	733	1 28	14
Total	1369. 75	$10 24	8874	$15 52	709

* At $15 per ton. † At $3. 50 per ton.

Cost of food for each pound gained, 3.58 cents.

PEN "C;" 3 STEERS; FED 120 DAYS.

(Ration, 1 pound C. S. M. to 3.4 pounds C. S. H.)

Ten day period.	Pounds *Cotton Seed Meal.	Cost.	Pounds †Cotton Seed Hulls.	Cost.	Pounds Gained.	Pounds Lost.
Dec. 4 to 13, inclusive	180	$1 35	545	$0 95	69	
Dec. 14 to 23, inclusive	195	1 46	663.5	1 16	110	
Dec. 24 to Jan. 2, inclusive	218	1 63	649	1 14	122	
Jan. 3 to 12, inclusive	215.5	1 62	698	1 22	60	
Jan. 13 to 22, inclusive	208.5	1 56	690	1 20	80	
Jan. 23 to Feb. 1, inclusive	234.5	1 76	721.5	1 26	74	
Feb. 2 to 11, inclusive	227	1 70	677	1 18	39	
Feb. 12 to 21, inclusive	230.5	1 73	663	1 16	30	
Feb. 22 to March 2, inclusive	222	1 66	663.5	1 16	54	
March 3 to 12, inclusive	215.5	1 62	643.5	1 13	61	
March 13 to 22, inclusive	209	1 57	625.5	1.09	67	
March 23 to April 1, inclusive	188	1 41	565	99	.....	47
Total	2543.5	$19 07	7804.5	$13 64	766 47	47
Net gain	.....	.....	.....	.....	719	

* At $15 per ton. † At $3.50 per ton.

Cost of food for each pound gained, 4.55 cents.

GENERAL CONCLUSIONS.

(1) In answer to the question, "*In what proportions should cotton seed meal and hulls be fed for cheapest gain in flesh for long and short fattening periods?*" the answer given by both experiments seems clear: At current or probable prices of meal and hulls, it pays best to feed some 5 or 6 pounds of hulls to every pound of meal eaten.

(2) The largest *daily gain in live weight* can be secured by feeding meal and hulls in a very common proportion of 3 pounds of hulls to 1 pound of meal. The quicker gain, secured by increasing the amount of meal fed daily from some 4 pounds to 6 pounds, increases the cost of feeding each steer $1.25 or $1.50 for every 100 days.

(3) Changing the amount of cotton seed meal from a light feed of meal for first 50 days to heavy meal feed for last 70 days gave results of no marked value, although the change of ration clearly added to the cost of maintenance.

(4) We were totally unable to cause "fat sickness" in steers fed on *sound, dry* cotton seed meal and hulls when combined in various proportions and fed for 150 days, continuing into hot weather.

(5) When less than $2\frac{1}{2}$ pounds of hulls is fed to 1 pound cotton seed meal the appetite is disturbed and indigestion is produced, resulting in light feeding and slow gains.

(6) From the trials here reported, we may safely conclude that when the *price* of a ton of cotton seed meal as compared with a ton of hulls is as *5 to 1*, then a pound of meal fed should be accompanied by at least 5 pounds of hulls. When the difference in price widens, then the hulls should be correspondingly increased. Thus, if meal be worth $15 per ton and hulls $3, at least 5 pounds of hulls should be fed to each pound of meal; if meal be worth $15 and hulls $2 per ton, $7\frac{1}{2}$ pounds of hulls should be fed to every pound of meal—provided the steers eat freely of the foods mixed in this proportion.

REMARKS: These experiments were planned and conducted by the authors, and the feeding was done by post-graduate students W. D. Clayton, B. S., and W. F. Hutson, B. S., to whom is due much credit for careful feeding, watering, and weighing, and a watchful interest exercised throughout the two experiments.

SUMMARY OF STEER FEEDING EXPERIMENTS BY TEXAS EXPERIMENT STATION.

BULLETIN NO. 2, MAY, 1888, 14 pages.

(Out of print.)

"To test the value of cob and shuck, in cattle feeding; corn, cob and shuck being ground together. An experiment designed to test the value of cob and shuck meal, which has been carried out by students of the second class under the immediate supervision of Assistant Professor Duggar.

"Six head of steers, each coming two years old the present spring, were selected and divided into two lots of three each, as shown in annexed tables.

"To Lot 1 was fed shelled corn ground coarsely; an amount which was entirely eaten up was fed twice daily, each steer in the lot receiving the same amount.

"To Lot 2 was fed an amount of corn, cob and shuck ground coarsely together, which contained a weight of clear corn equaling the amount fed to LOT 1; or since shelled corn weighs 56 lbs. per bushel, and corn in the ear with shuck attached averages 72 lbs. per bushel, the amount fed to LOT 2 was always compared with amount fed to LOT 1 in the ratio of 72 to 56, or as 9 to 7 by weight.

"Considering the foregoing in brief, it is found that the lot fed on 'chops' alone made a gain in 70 days of 465 pounds, an average gain of 2.21 pounds per day and head, and requiring 4.008 pounds of feed to produce one pound of gain.

"The lot fed on an equal amount of 'chops,' with the cob and shuck added, as already noted, made a gain in 70 days of 480½ pounds, an average of 2.29 pounds per day and head, and requiring but 3.883 pounds of 'chops,' with cob and shuck added, to produce one pound of gain. The excess, although slight, shows in favor of a certain value in the cob and shuck, but it is a question as to whether the gain observed will pay for the extra time and power required to grind corn, cob and shuck together, at least when the small sweep mills ars used. GEO. W. CURTIS, Agriculturist."

BULLETIN NO. 6, JUNE, 1889, 39 PAGES.

(Out of print.)

STEER FEEDING EXPERIMENT.

"Four questions are submitted to the cattle and feed stuffs employed.

"1. Is it possible to conduct a feeding test that will be sufficiently accurate to be of value, and at the same time make it an object lesson to the practical cattle man and give him information which he can make use of?

"2. Is there any practicable method of sheltering range steers in winter feeding, and will it be profitable?

"3. What feed stuffs that are obtainable in the State will give the best results in proportion to cost?

"4. Can the common, unimproved Texas steer be fattened with profit?

"Shelter.—We assume that economical feeding in Texas must include shelter, and that the solution of the problem, how to make sheltering practicable with range steers, is essential to an improved and profitable method of feeding. We therefore adopted the plan of removing the horns at the beginning of the experiment and allowed each lot of six steers to run loose together in their respective pens. The steers and eight old cows were simply 'roped,'

drawn up to a post and the horns sawed close to the head with a light butcher's saw, and the animals turned loose without further attention. Of the 60 head dehorned, all were eating regularly after three days, and most of the openings had closed up and ceased to discharge after the third week.

"*Feed Stuffs.*—In compounding formulaes for feed rations, we have thought best to use cotton seed in its various forms in nearly every combination, for the reason that over a considerable portion of the State cotton seed is one of the cheapest feed stuffs.

"We have also made use of silage largely, notwithstanding the fact that it is practically unknown in the State. That silage is one of the most economical and desirable feeding materials, where corn and sorghum thrive, has been conclusively demonstrated in every State east of the Mississippi river and several west. While there is much to learn in regard to the kind of crops to grow for silage, how to handle and how to feed them, no further experiments are required to determine that silage must be included in our feed stuffs if we propose to use the cheapest materials.

"Lots Nos. 8 and 9 were fed on hay and corn. No. 8 dehorned, and under shelter: No. 9, out of doors without removing the horns, to compare one lot with the other, and also to compare both lots with steers on rations containing cotton seed silage.

"The difference in gain and cost of food consumed shows that hay and corn alone are expensive feed stuffs at the prices given, compared with some of the other rations.

"*Profit in Feeding.*—Our experiment shows that in Pen 2, silage and cotton seed meal did not make as rapid gain nor as low cost as cotton seed hulls and cotton seed meal in Pen 6; the first making a gain of 170 pounds per head in 83 days, at a cost for food of 4.47 cents per pound gain; the second, a gain of 202 pounds per head, at a cost for food of 3.62 cents per pound gain.

"In Pen No. 7, cotton seed hulls, silage and cotton seed meal made 178 pounds gain, at a cost of 3.93 cents per pound, indicating that the hulls at the price given have a higher food value than silage. We confess we are not a little surprised with the result, for it does not look reasonable that the dry, hard, and to a large extent indigestible, cotton seed hulls have a higher food value than silage. Owing to delay from accident while harvesting our corn, it was not ensiloed until nearly ripe, a good deal of it quite dry. This may have made it less digestible, or it may be that Pens 6 and 7 were better feeders than Pen 2.

"Pen 3 on silage and boiled seed made the gain at the least cost per pound, and Pen 4, silage and raw seed, the second lowest in cost; which would indicate that cotton seed, at a valuation of $7 per ton, is a cheaper feed with silage than cotton seed meal at $20 per tons with silage or with hulls.

"Our experiment indicates that 200 pounds gain in weight may be made from $6 to $9 worth of silage, cotton seed, cotton seed meal and cotton seed hulls, leaving a good margin for profit after deducting cost of labor, wear and tear of plant, and use of capital.

"*Effect of Dehorning.*—It will be noticed in table 14 that with the exception of Pens 2, 3 and 6, the steers in all the pens lost weight the first week, some making no gain for twelve days. The loss of weight might be charged to dehorning, but it will also be noticed that steers in Pen 9, not dehorned and running loose in a half-acre lot, lost the most in weight the first week, and, excepting Pen 4, were the last to begin gaining. The steers were dehorned on the 8th and 9th of January. For two days they were dumpish, lying down a good deal of the time, and did not appear to have much appetite; still the evidence goes to show that failure to gain in weight from the start is due more to change in food and confinement than to removing the horns. Experiments in Arkansas, Tennessee and Wisconsin support this view.

"*Effect of Different Rations.*—If we compare the gains made in weight of steers in Pens 3 and 4 to Feb. 25, and note also the quantity of cotton seed and silage consumed to that date (see tables 1, 2), the gain is greater on the cooked seed in proportion to silage and cotton seed consumed, and the gain on cooked seed much the more rapid of the two, but we find at the close of the experiment (Table 13) that the cost of feed for each pound gained is practically the same. The steers in Pen 3 made largest gain, so that from an economic standpoint the cooked seed made considerably the best return, the

steers in Pen 3 having a higher value per pound owing to their better condition. Pen 6, on cotton seed hulls and cotton seed meal, made a steady gain from the first, but not equal to Pen 3 until after seven weeks' feeding. The high value of cotton seed hulls and cotton seed meal for fattening cattle is shown by this experiment.

SUMMARY OF TABLES.

Live Weights, Gains and Cost of Rations.

No. of pen.	Average weight of cattle.	Pounds—Average gain per cwt.	Pounds—Average gain per day.	Pounds—Average total gain.	Average cost of food per lb. gain.	Average cost of food per head.	Ration Fed.
1	724	17. 7	2. 67	128	3. 14cts.	$4 02*	Silage, corn fodder, boiled cotton seed, cotton seed meal.
2	696	24. 3	2. 05	170	4. 47cts.	7 61*	Silage, cotton seed meal and hay.
3	777	22. 2	2. 08	173	2. 85cts.	4 95*	Silage, boiled cotton seed and hay.
4	827	17. 8	1. 80	148	2. 86cts.	4 22*	Silage, raw cotton seed and hay.
5	808	24. 4	2. 37	197	5. 00cts.	9 94	Silage, cotton seed meal, corn and cob meal and hay.
6	741	27. 2	2. 43	202	3. 63cts.	7 31*	Hulls, cotton seed meal.
7	722	24. 6	2. 20	178	3. 93cts.	6 97*	Silage, hulls, cotton seed meal and hay.
8	728	23. 8	2. 09	173	4. 17cts.	7 23*	Hay, corn in ear.
9	876	18. 0	1. 90	158	6. 83cts.	10 79	Hay, corn in ear, out doors.

SUMMARY OF TABLES.

Average Gain per Head from Beginning. Gain to Date from January 8.

No. of pen.	Av. weight at beginning—Jan. 8.	January 14.	January 17.	January 21.	January 24.	January 28.	January 31.	February 4.	February 8.	February 25.	March 11.	March 31.	Ration Fed.
1	724	.....	5	8	32	45	60	62	79	128	.....	.....	Silage, corn fodder, boiled cotton seed, and cotton seed meal.
2	696	12	.....	12	27	44	59	65	72	122	138	170	Silage, cotton seed meal, hay.
3	777	16	.....	15	41	51	61	64	79	146	161	173	Silage, boiled cotton seed, hay.
4	827	–4	–15	–7	12	26	32	36	45	86	111	148	Silage, raw cotton seed, hay.
5	808	–12	–18	11	27	35	53	43	69	127	153	197	Silage, cotton seed meal, corn and cob meal, hay.
6	741	3	15	44	35	52	62	64	86	118	171	202	Cotton seed hulls, cotton seed meal.
7	722	–30	–20	4	21	40	37	45	71	123	153	177	Silage, cotton seed hulls, cotton seed meal, hay.
8	728	.....	6	11	15	14	25	20	45	111	134	173	Hay, corn on cob with shuck.
9	876	20	–18	–6	13	7	11	23	26	89	117	158	Hay, corn on cob with shuck.

The last weight is the average of two weighings made March 30 and April 1.

"*Conclusions.*—There is a clear advantage from analysis in favor of Texas silage over that reported from Northern States. The water is lower, while the other ingredients are all higher, but the crude fibre not sufficiently so to detract materially from the value of the silage. We can not say if subsequent work will confirm these discrepancies.

"There seems to be little difference between the value of the corn silage and that of the pea-vine silage. The changes in the pea-vine silage in the silo are not truly such as would have been expected. The nitrogenous matter in the silo decreased and the fatty acids increased, as would have been anticipated. But there was also a slight increase of crude cellulose and a decrease in nitrogen free extract.

"The sugar cane bagasse is not equal to silage in nutritive value, but it makes a good showing and requires further investigation. A remarkable thing about it is the *large percentage of fats.*

"We believe the answer is clear as to necessity of shelter. The result confirms several years' experience and observation in feeding cattle in the Southern States, but dehorning is essential to make sheltering range cattle practicable. The evidence in favor of shelter confirms results secured as a rule by careful feeders, and the same is true of dehorning.

"For roughness, corn, sorghum and pea-vine silage, hay where it can be produced at low cost, and cotton seed hulls near oil mills.

"For the richer part of the ration, boiled cotton seed, cotton seed meal, with perhaps some corn, rice meal or rice bran in sections where they can be produced cheaply.

"Corn and sorghum grown for silage should be planted thin enough to mature ears and produce a crop of seed, and not harvested until ripe. The silage will then contain a considerable amount of grain, and be of more value to feed with cotton seed and with cotton seed meal and produce a better quality of beef.

"With a margin of 1 cent per pound gross between thin and fat cattle, steers may be profitably fed over a large portion of the State (see page 9).

"The experiment indicates that silage and boiled cotton seed is the cheapest and most rapid fattening ration of the feedstuffs.

"2. Cotton seed meal and cotton seed hulls.

"3. Cotton seed meal, cotton seed hulls and silage.

"4. Raw cotton seed and silage.

"5. Corn and hay at the prices given.

"F. A. GULLEY, Director."

BULLETIN NO. 10, MAY, 1890, 31 PAGES.

(Out of print.)

This experiment is a continuation of the feeding experiments inaugurated last winter, and reported in Bulletin No. 6.

Fifty-five head of cattle were fed on different rations, made up of hay, corn, cotton seed, raw and cooked, cotton seed hulls, cotton seed meal, and silage. The results showed that range steers may be dehorned and fed loose under a shed, crowded together like sheep, successfully, and that cost of certain food consumed is much less than increased value of steers from gains made in weight at selling prices of food and steers.

In regard to comparative results from different feed-stuffs, silage and cotton seed hulls for roughness, and cooked cotton seed and cotton meal, with or without corn, made more rapid gain than hay and corn, and at less cost. Cattle not sheltered consumed more food, and made less gain in weight, than cattle fed under sheds.

From the result of this and other experiments, we assume that, except in favored and exceptional hay-producing sections, cotton hulls in the vicinity of the oil mills, and corn and sorghum silage elsewhere in the State, supply rough fodder in the cheapest form to the cattle feeder as the basis of food rations. and we also assume that the best method of handling the cattle is to saw the horns off close to the head, and feed the cattle under shelter, unless the winter is exceptionally dry.

An examination of the tables in Bulletin No. 6 will show that steers dehorned and fed under shelter made larger gains than steers not dehorned and not sheltered, and at less cost for food.

Several questions are put to the cattle and feed-stuffs in this experiment, but the two leading questions are:

1. What is the best to feed with cotton hulls?
2. What is best to feed with silage?

Incidentally, we ask:

a. If sweetening the ration will make it more palatable to cattle?

b. Is corn silage a better cattle food than dry corn fodder?

c. What is the comparative value or cotton seed and cotton meal for feeding?

d. Is corn the best grain to feed with corn silage?

f. Will changing the ration stimulate the appetite and cause cattle to fatten more rapidly?

g. Will hogs do as well running after silage and cotton meal fed cattle as after hay, corn, and cotton seed fed cattle?

h. Will cotton seed improve the corn and hay ration?

i. Is cotton hulls and cotton meal a good food to fatten sheep?

CATTLE USED.

Two lots of cattle were used. Lot 1, 50 head raised in Williamson county, twos and threes, all having some Shorthorn or Hereford blood, and in good condition, but never having been handled, nor had extra care or feed.

Lot 2, 22 head, was purchased in Waller county, with the expectation of getting native range cattle to compare with steers having a dash of improved blood. The cattle were ordinary, in rather thin condition, as is shown by the weights, Pens 12, 13 and 14, but they were not so wild as the Williamson county steers, having, as we learned later, grazed around the settlements and learned to eat. They were from 4 to 6 years old.

As soon as received, the cattle were dehorned and put into the pens to feed. The three and four steer lots occupied pens 10x14 feet, with an outside open yard twice as large. The six and eight steer lots, pens 14x20 feet, outside yards same proportion. The ten steer lots, in pens 10x30 feet, with outside yards 30x30 feet. Pen 14 was not dehorned, and the steers were fed in an open dry yard. The cattle were not tied.

Lot 1 was fed 90 days; lot 2, 79 days. At the end of this period of feeding there was considerable difference in the gains made by the different pens from different rations. (See tables 6 to 20.) To even the cattle up for shipment, the divisions between the pens were removed, the cattle turned together, and all fed alike, but with a combination of feed-stuffs different from that of the first period.

The effect of greater freedom, change and variety of food is shown in the *rapid increase, even after the cattle had been fed* 79 and 90 days, and made an average gain of over 200 pounds per head. See gains, Tables 6 to 19, and Summary 1.

This feeding experiment was planned with special reference to testing the principal available feed-stuffs of the State under as near similar conditions as may be provided by men feeding for profit as possible.

In testing a number of different rations, however, we can not avoid artificial conditions to some extent, but they are such as interfere with securing the best results in increase in weight. Confining steers in small pens is not the best method of handling them; nor is it desirable to use the same feed-stuffs without change for the entire period of feeding.

An examination of the weights of the cattle, after having been fed 60 days, will show that the gain per day as a rule decreased the longer time they were fed, and some of the pens lost in weight from the 80th to the 90th day (see Table No. 21), yet, as soon as the steers were given opportunity to move around, and a greater variety of food, they commenced to gain in weight at once, making in some pens a larger gain per day from the 90th to the 110th day than during the first period of feeding.

The frequent weighing of cattle disturbs them and interferes with rapid gain. Nevertheless, the increase in weight of the two lots, an average of 246.5 pounds in 110 days with one, and 286.1 pounds in 90 days with the other, is very good, and especially so where some ten different rations have been fed.

FIRST LOT OF STEERS.

Pen 1—6 Steers.

Consumed per head in 90 days:

279.68 lbs.	corn fodder, at $5 per ton	$ 70
826. lbs.	silage, at $2 per ton	83
717.72 lbs.	cotton seed, cooked, at $7 per ton	2 51
27.84 lbs.	hay	08
		$4 12

Average weight, 793.33 lbs. Average gain, 161.6 lbs. Gain per cwt., 21 lbs. Value of food consumed for each pound gained, 2.55 cents.

Pen 2—4 Steers.

Consumed per head in 90 days:	
2159.75 lbs. silage, at $2 per ton	$2 15
380.27 lbs. corn and cob meal, at 40 cents per bushel for the corn	2 17
323.75 lbs. cotton meal, at $20 per ton	3 23
	$7 55

Average weight of steers, 692.5 lbs. Average gain per head, 163.75 lbs. Gain per cwt., 23.9 lbs. Value of food consumed per each pound gained, 4.6 cents.

Pen 3—6 Steers.

Consumed per head in 90 days:	
2018 lbs. silage, at $2 per ton	$2 02
685 lbs. cotton seed, cooked, at $7 per ton	2 39
359 lbs. hay, at $6 per ton	11
	$4 52

Average weight of steers, 755.8 lbs. Average gain per head, 164.1 lbs. Gain per cwt., 21.8 lbs. Value of food consumed per pound gained, 2.7 cents.

Pen 4—4 Steers.

Consumed per head in 90 days:	
3401.6 lbs. silage, at $2 per ton	$3 40
507.55 lbs. cotton meal, at $20 per ton	5 08
3.62 gallons molasses, at 20 cents	72
	$9 20

Average weight, 731.25 lbs. Average gain, 200 lbs. Gain per cwt., 27.3 pounds. Value of food consumed for each pound gained, 4.47 cents.

Pen 5—4 Steers.

Consumed per head in 90 days:	
3822.47 lbs. silage, at $2 per ton	$3 82
496.4 lbs. cotton meal, at $20 per ton	4 96
	$8 78

Average weight of steers, 737.5 lbs. Average gain, 228.75 lbs. Gain per cwt., 31 lbs. Value of food consumed for each pound gained, 3.83 cents.

Pen 6—3 Steers.

Consumed per head in 90 days:	
1387. lbs. silage, at $2 per ton	$1 39
1306.9 lbs. cotton hulls, at $3 per ton	1 96
531.5 lbs. cotton meal, at $20 per ton	5 31
	$8 66

Average weight, 780 lbs. Average gain, 233.33 lbs. Gain per cwt., 29.9 lbs. Value of food consumed for each pound gained, 3.71 cents.

Pen 7—4 Steers.

Consumed per head in 90 days:	
1564 lbs. cotton hulls, at $3 per ton	$2 34
534 lbs. cotton meal, at $20 per ton	5 34
	$7 68

Average weight of steers, 713.75 lbs. Average gain, 206.25 lbs. Gain per cwt., 28.8 lbs. value of food consumed for each pound gained, 3.72 cents.

Pen 8—4 Steers.

Consumed per head in 90 days:

1493. lbs. cotton hulls, at $3 per ton	$2 22
366.85 lbs. cotton meal, at $20 per ton	3 67
447.45 lbs. corn and cob meal, at 40 cts. per bushel for the corn	2 56
	$8 45

Average weight of steers, 785.5 lbs. Average gain, 206.25 lbs. Gain per cwt., 23.6 lbs. Value of food consumed for each pound gained, 4.09 cents.

Pen 9—8 Steers.

Consumed per head in 90 days:

1245.25 lbs. cotton hulls, at $3 per ton	$1 89
532.12 lbs. cotton meal, at $20 per ton	5 32
568.26 lbs. mixed hay, at $6 per ton	1 69
	$8 90

Average weight of steers, 725.6 lbs. Average gain, 215 lbs. Gain per cwt., 29.7 lbs. Value of food consumed for each pound gained, 4.13 cents.

Pen 10—4 Steers.

Consumed per head in 90 days:

1677.7 lbs. cotton hulls, at $3 per ton	$2 51
530.5 lbs. cotton meal, at $20 per ton	5 31
5.57 gallons molasses, at 20 cents per gallon	1 12
	$8 94

Average weight of steers, 727.5 lbs. Average gain, 238.75 lbs. Gain per cwt., 32.8 lbs. Value of food consumed for each pound gained, 3.73 cents.

Pen 11—3 Steers.

Consumed per head in 90 days:

1884.73 lbs. cotton hulls, at $3 per ton	$2 83
599.63 lbs. cotton meal, at $20 per ton	6 00
7.48 gallons molasses, at 20 cents per gallon	1 50
	$10 33

Average weight of steers, 868.33 lbs. Average gain, 251.6 lbs. Gain per cwt., 28.9 lbs. Value of food consumed for each pound gained, 4.1 cents.

SECOND LOT OF STEERS.

Pen 12—10 Steers.

Consumed per head in 79 days:

1758.7 lbs. silage, at $2 per ton	$1 76
1019.1 lbs. cotton hulls, at $3 per ton	1 53
430. lbs. cotton meal, at $20 per ton	4 30
	$7 59

Average weight of steers, 671 lbs. Average gain, 279 lbs. Gain per cwt., 41.5 lbs. Value of food consumed for each pound gained, 2.72 cents.

Pen 13—9 Steers.

Consumed per head in 79 days:

922.97 lbs. silage, at $2 per ton	$ 92
370.53 lbs. hay, at $6 per ton	1 11
485.8 lbs. (6.07 bu.) corn in ear, at 40 cents	2 42
430.56 lbs. cotton seed, raw, at $7 per ton	1 50
	$5 95

Average weight of steers, 662.8 lbs. Average gain, 222.2 lbs. Gain per cwt., 33.5 lbs. Value of food consumed for each pound gained, 2.67 cents.

Pen 14—3 Steers.

Consumed per head in 79 days:

591.53 lbs. hay, at $6 per ton	$1 77
1211. lbs. (15.13 bu.) corn in ear, at 40 cents per bushel	6 05
342.54 lbs. cotton seed, cooked, at $7 per ton	1 19
	$9 01

Average weight of steers, 636.6 lbs. Average gain, 233.3 lbs. Gain per cwt., 36.4 lbs. Value of food consumed for each pound gained, 3.86 cents.

COST OF FOOD.

The values given to the different feed-stuffs are fully one-fourth higher than actual cost the past year to cattle feeders and farmers, or at the oil mills in Texas. Throughout the corn belt of the State, on the farms, corn was worth less than 30 cents per bushel; hay on the farm not above $4.50 per ton; cotton meal at the mills $16, and hulls $1.50 per ton and less. Having assumed the values given, with the first feeding experiment, it is thought best to retain the same to facilitate comparing one year's work with another. The values of feed and cost of one pound gained in weight may be easily calculated for any portion of the State.

HOGS WITH COTTON SEED FED CATTLE.

Pigs were put in with the cattle in Pens 12 and 13, one pig to each steer, and the increase in weight determined from January 26 to March 16, fifty days.

Very little food was scattered on the ground in feeding the cattle (the mangers were constructed so that the steers could not throw it out), and the pigs were practically confined to the droppings of the cattle and corn fed to them direct.

It was thought best to feed each lot of pigs sufficient corn to keep them quiet and in good growing condition, but not enough to keep them from getting hungry.

In Pen 12, cattle fed silage, cotton hulls, and cotton meal:	Pounds.
January 26, average weight of pigs	57
March 16, average weight of pigs	87.5
Average gain per head	30.5
Pounds corn per head	132
Pounds corn fed per pound gain	4.39

Pen 13, cattle fed silage, hay, corn in ear, and raw cotton seed:

January 26, average weight of pigs	52
March 16, average weight of pigs	86
Average gain per head	34
Pounds corn fed per head	108.3
Pounds corn fed per pound gain	3.18

In Pen 12, one bushel corn, in addition to cattle waste, made 12.75 pounds gain.

In Pen 13, one bushel corn, in addition to cattle waste, made 17.61 pounds gain.

The waste from silage, hay, corn, and cotton seed fed steers gave approximately 36 per cent more increase in weight than the waste from silage, cotton meal, and hull fed steers.

The low increase in weight made as compared with the usual gains made by hogs running after fattening cattle may be accounted for, perhaps, by the crowded condition of the pens, and the fact that practically none of the food given to the cattle was thrown on the ground where the pigs could get it.

In the usual manner of feeding corn and hay in racks in open lots, a considerable quantity of the corn is dropped on the ground in filling the troughs, and the cattle throw out a good deal, so that pigs are by no means confined to the undigested corn voided by the cattle.

There is no question but that in feeding dehorned cattle under shelter, with properly arranged troughs, even with whole corn and hay, that the value of the waste for hog food will be decreased 30 to 50 per cent compared with the ordinary method of feeding, and that when whole corn is replaced partly or wholly by corn meal, cotton seed, and cotton meal, that the value of the waste will again be reduced to a considerable extent.

The cattle and pigs were in too close quarters for the best welfare of the pigs, and this single test, no doubt, does not fairly represent the full value of the waste from the two rations fed to cattle. The two lots of pigs had an equal chance, and it may, therefore, represent the comparative value of the two rations.

SILAGE AND COTTON SEED HULLS FOR SHEEP.

Two lots of common native sheep, nine in each, were put in pens, and one fed on silage and raw cotton seed, the other on cotton hulls and cotton meal. The sheep were fed all they would eat for 64 days.

Pen 1, 9 sheep, fed silage and cotton seed:	Pounds.
Average weight January 1	62
March 6, average gain per head	12.4
Average gain per head per day	.193
Silage consumed per head per day	2.62
Cotton seed consumed per head per day	.814
Food consumed per head:	
169.75 pounds silage, at $2 per ton	17 cts.
52.17 pounds cotton seed, at $7 per ton	18 cts.
Cost of food for 64 days	35
Cost of food per pound gain (cents)	2.82

Pen 2, 9 sheep, fed cotton hulls and cotton meal:	Pounds.
Average weight January 1	61.5
March 6, average gain per head	17.8
Average gain per head per day	.278
Cotton hulls consumed per head per day	.97
Cotton meal consumed per head per day	.97
Food consumed per head:	
62.2 pounds cotton hulls, at $3 per ton	9.2 cts.
62.2 pounds cotton meal, at $8 per ton	62.2 cts.
Cost of food for 64 days	71.4
Cost of food per pound gain	4 cts

The foregoing test was made preliminary to feeding several pens of sheep to compare the effect of different rations on sheep, and returns made by cattle and sheep for food consumed.

The sheep seemed to take their food regularly, but they did not eat enough, and did not gain in weight, as they should.

It required 13.75 pounds silage and 4.20 pounds cotton seed to produce 1 pound gain in weight, and 3.49 pounds cotton hulls and 3.49 pounds cotton meal to produce 1 pound gain in weight.

Sheep have been successfully fattened on cotton hulls and cotton meal, and we must, therefore, charge our lack of success to poor quality of the sheep or to unskillful feeding.

CONCLUSIONS.

1. The experiments for the two winters show that of our different cattle foods, a ration made up of cotton hulls and cotton meal is equal, if not superior, to a ration of any other two feed-stuffs used for fattening cattle, but a cheaper ration may be compounded of silage and cotton seed, or of corn, hay, and cotton seed, at the prices given.

2. That the addition of some other feed-stuff to the cotton hull and cotton

meal ration makes it more palatable to cattle, and produces better results in gain in weight. Corn meal, hay, silage, and molasses, each one added in cotton hulls and cotton meal, made larger gains than hulls and meal alone, in the order named, molasses giving the best result.

3. Of the several rations containing silage, silage, cotton hulls, and cotton meal gave the best gains. Silage and cotton meal second. Silage and boiled cotton seed third. Silage, corn and cob meal, and cotton meal fourth. Silage, corn and cob meal fifth. Dry corn fodder did not give as large gain as silage. Molasses did not improve the ration containing silage.

4. Cotton hulls and cotton meal with hay, corn, silage, and molasses gave larger gains than silage and cotton meal, or silage and cotton seed.

5. Cotton seed meal, with other feed-stuffs and fodders, gave larger gains than cotton seed with other feed-stuffs and fodders.

6. Cotton seed, with other feed-stuffs and fodders, made gains at less cost for food per pound gain than cotton meal with other feed-stuffs and fodders.

7. After feeding any of the rations used without change for 60 days, the daily gain diminished until finally, in some pens, it ceased entirely; but with a change of ration, the daily gain in all of the pens was largely increased, in some pens exceeding the average of the first period of feeding.

8. Corn and hay alone is more costly, and will not fatten cattle so rapidly as rations containing cotton seed and cotton meal, with cotton hulls or silage; and boiled cotton seed added to the corn and hay ration makes more rapid gain than corn and hay alone, and at considerable less cost per pound for food consumed.

9. The waste from cattle fed hay, corn, silage, and raw cotton seed was worth considerable more for hogs running after the steers than the waste from cattle fed silage, cotton hulls, and cotton seed meal.

F. A. GULLEY,
J. W. CARSON.

BULLETIN NO. 27, JUNE, 1893, 16 PAGES.

(Out of print.)

STEER FEEDING.

The practice of feeding boiled cotton seed to both dairy and beef cattle has long been in vogue, but the feeding of roasted cotton seed is of much more recent date.

First: In this experiment, a test is made of the relative feeding values of cotton seed, roasted, boiled and raw.

Second: Also to compare cotton seed, corn and hay rations with a ration of corn and hay only.

Third: To test a ration of cotton seed meal, hulls and silage with the other rations fed.

STEERS FED.

For conducting this test, a lot of twenty native steers was purchased in the month of February, 1892, and are known as "Lot A." These steers were each coming two years old in the spring, and though very thin in flesh were carefully selected with reference to evenness in size, weight and general feeding qualities, reducing individual variation to the minimum. They were dehorned and fed in groups of four, under shelter in pens measuring 10x14 feet, opening into an outside enclosure 20x32 feet. Each pen was given a ten days' preliminary feeding, in order to accustom them to the food before the weights were taken, and the average of three daily weighings was taken to represent the weight of each steer at the beginning of the experiment.

In order to arrive at the most accurate conclusions possible, another test was planned, and these steers, "Lot A," at the termination of the fifty days' feeding, were put to pasture and used again the following winter in making a duplicate test. When fed the second winter they are known as "Lot A. A.," to distinguish them from another bunch of twenty steers, which were fed at the same time and known as "Lot B."

Lot A, fed (March 2d to April 20th, 1892) 50 days.
Lot A. A., fed (December 1st, 1892, to March 10th, 1893) 100 days.
Lot B., fed (December 1st, 1892, to March 10th, 1893) 100 days.

Lot B consisted of twenty native steers coming three years old in the spring and averaging slightly younger than those of "Lot A." They were purchased just before the second test was begun and were immediately dehorned. The first "Lot A" (fed the preceding spring) was in much better condition as to flesh than was Lot B, in which all were thin, but apparently in good health.

These steers of "Lot A. A." having been tagged the previous spring, were grouped exactly as in first experiment and were fed on same rations as before.

COST OF FOOD STUFFS.

It will be noted that cotton seed boiled is rated at $2 and roasted seed $3 per ton higher than raw seed to cover the actual cost of preparation. It will also be noted that a table appears, in which the cost of food is calculated at a higher rate than that before used to indicate present market values. See page 320.

The hay used in all of the tests was a poor quality of prairie hay, valued at $6 per ton. The corn was ground in the ear and fed as corn and cob chops, valued at 40 cents per bushel in the ear. The silage fed was pure corn silage cut and put into silo at the ordinary stage, too hard for roasting ears.

Weights of *roasted* and *boiled* cotton seed are given in tables from the dry raw seed, which were treated and fed after being weighed.

The following statements are conveniently arranged to show for each pen the total cost of food consumed, average weight of steers at beginning of test, average gain per head, gain per cwt. and cost of food per pound gained:

For easy reference and comparison of results, we give the following summaries:

SUMMARY NO. 1.

Lot "A," Fed 50 Days, March 2 to April 20, 1893.

No. of pen.	Pounds—Average weight of steers at beginning.	Pounds—Average gain per head.	Pounds—Gain per day.	Pounds—Gain per cwt.	Cost of food per pound gained.	Cost of food per head.	Ration fed 50 days.
1	462	118	2.36	27.7	2.94cts.	$3 48	Cotton seed meal, hulls and silage.
2	431	131	2.62	30.4	2.61cts.	3 42	Roasted cotton seed, corn and hay.
3	435	136	2.72	31.2	2.51cts.	3 40	Boiled cotton seed, corn and hay.
4	413	118	2.36	28.5	2.36cts.	2 79	Raw cotton seed, corn and hay.
5	440	76	1.52	17.2	3.71cts.	2 82	Corn and hay.

From this table we have the following results:

(a) The cheapest pound gained was by Pen 4; second, Pen 3.
(b) The dearest pound gained was by Pen 5; second, Pen 1.

(c) The cheapest feed per day was fed Pen 4; second, Pen 5.
(d) The dearest feed per day was fed Pen 1; second, Pen 2.

(e) The greatest gain was made by Pen 3; second, Pen 2.
(f) The least gain was made by Pen 5; second, Pen 1.

SUMMARY NO. 2.

Lot "AA," Fed 100 Days, December 1, 1892, to March 10, 1893.

No. of pen.	Pounds—Average weight of steers at beginning.	Pounds—Average gain per head.	Pounds—Gain per day.	Pounds—Gain per cwt.	Cost of food per pound gained.	Cost of food per head.	Ration fed 100 days.
1	638	186	1.86	29.1	4.32cts.	$8 05	Cotton seed meal, hulls and silage.
2	625	199	1.99	31.8	3.71cts.	7 40	Roasted cotton seed, corn and hay.
3	630	207	2.07	32.8	3.70cts.	7 66	Boiled cotton seed, corn and hay.
4	576	192	1.92	33.3	3 29cts.	6 33	Raw cotton seed, corn and hay.
5	615	203	2.03	33	4.95cts.	10 05	Corn and hay.

From this table we have the following results:

(a) The cheapest pound gained was made by Pen 4; second, Pen 3.
(b) The dearest pound gained was made by Pen 5; second, Pen 1.

(c) The cheapest feed per day was fed Pen 4; second, Pen 2.
(d) The dearest feed per day was fed Pen 5; second, Pen 1.

(e) The greatest gain was made by Pen 3; second, Pen 5.
(f) The least gain was made by Pen 1; second, Pen 4.

SUMMARY NO. 3.

Lot "B," Fed 100 Days, December 1, 1892, to March 10, 1893.

No. of pen.	Pounds—Average weight of steers at beginning.	Pounds—Average gain per head.	Pounds—Gain per day.	Pounds—Gain per cwt.	Cost of food per pound gained.	Cost of food per head.	Ration fed 100 days.
1	513	266	2.66	52.04	2.99cts.	$7 81	Cotton seed meal, hulls and silage.
2	513	222	2.22	43.3	3.3 cts.	7 33	Roasted cotton seed, corn and hay.
3	509	223	2.23	43.8	3.27cts.	7 31	Boiled cotton seed, corn and hay.
4	511	208	2.08	40.7	2.84cts.	5 92	Raw cotton seed, corn and hay.
5	522	193	1.93	36.9	4.77cts.	9 21	Corn and hay.

From this table we have the following results:

(a) The cheapest pound gained was made by Pen 4; second, Pen 1.
(b) The dearest pound gained was made by Pen 5; second, Pen 2.

(c) The cheapest feed per day was fed Pen 4; second, Pen 3.
(d) The dearest feed per day was fed Pen 5; second, Pen 1.

(e) The greatest gain was made by Pen 1; second, Pen 3.
(f) The least gain was made by Pen 5; second, Pen 4.

CONCLUSIONS.

As a result of this series of experiments, we conclude that:

First: Roasted cotton seed do not have the laxative qualities of raw seed, and are more palatable.

Second: Faster gains are made by feeding the Boiled Seed, but at a greater cost per pound gain.

Third: The advantages to be gained in the use of Roasted Seed hardly justifies its general use.

Fourth: Boiled Seed are more palatable than Raw Seed, less laxative and make faster gains. May continue to be used with profit.

Fifth: Steers fed on raw seed, eating a less quantity of seed, ate slightly more hay in consequence.

Sixth: Cotton Seed, at usual prices, is a good and cheap addition to a corn and hay ration.

Seventh: The best beef ration found by previous experiments—Cotton Seed, Meal, Hulls and Silage is not here proven the best, when calculated at former prices—Raw Seed, Corn and Hay being better. (See table 3, page 320.)

Eighth: When value of Raw Seed is raised to near market present prices, $10 per ton, the Meal, Hulls and Silage is again the best ration (see bulletin 10, page 28): Raw Seed, Corn and Hay being next best.

Ninth: The average cost of gain per pound in all Lots at present price of foods was 3.64 cents.

Tenth: The cheapest feed per pound gained for all steers fed, when raw cotton seed is valued at $10 per ton, was raw seed, corn and hay.

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